STAFF REPORT

THE DISCHARGE OF GRAYWATER FROM HOUSEBOATS TO SHASTA LAKE SHASTA COUNTY

The Bureau of Reclamation's Shasta Dam is a key facility in the Central Valley Project (CVP) that supplies domestic and irrigation water to much of the state. The waters behind Shasta Dam back up into four river canyons: the Sacramento River, McCloud River, Pit River, and Squaw Creek "arms". At elevation 1067, Shasta Lake has 365 miles of shoreline and a total volume of 4,552,000 acre-feet. Shasta Lake is one of the heaviest utilized recreational lakes in California with approximately 3 million visitors annually. The peak recreation season is from Memorial Day to Labor Day.

The U.S. Department of Agriculture, Forest Service, Shasta/Trinity National Forest (Forest Service) administers the Shasta Lake National Recreation Area for the public and issues special use permits for houseboats that have historically discharged shower, sink, dishwater, and laundry water (graywater) into Shasta Lake. Based on recent information and data, Regional Board staff recommends the elimination of graywater discharges from houseboats to Shasta Lake. The basis for this recommendation is that there are large numbers of houseboats on the lake that discharge graywater. Houseboat graywater is a high strength, high pathogen waste, and allowing such discharges to continue is not consistent with the Regional Board's mandate to protect beneficial uses of surface waters.

THE BENEFICIAL USES OF SHASTA LAKE

The Water Quality Control Plan (Basin Plan) for the Sacramento and the San Joaquin River Basins designates beneficial uses, establishes water quality objectives, and contains implementation plans and policies for protecting waters of the Basin. The beneficial uses of Shasta Lake are municipal and domestic supply, industrial supply, and agricultural supply; hydropower generation; water contact and non-contact recreation; aesthetic enjoyment; freshwater habitat; fish spawning; wildlife habitat; and preservation and enhancement of fish, wildlife, and other aquatic resources. The Basin Plan specifically prohibits the direct discharge of municipal and industrial wastes, including toilet wastes from houseboats, directly to Shasta Lake.

Three large drinking water systems, regulated by the California Department of Health Services, and five small drinking water systems, regulated by the Shasta County Environmental Health Department, have intakes in Shasta Lake. One unregulated private water system pumps water from the lake, treats, and uses it at their facility. Commercial and private houseboats also pump Shasta Lake water and use it as non-potable supply on their vessels. Water contact and non-contact recreation activities include: swimming, wading, water-skiing, fishing, picnicking, sunbathing, hiking, camping, boating, sightseeing, or aesthetic enjoyment in conjunction with the above.

SHASTA LAKE HOUSEBOATS

There are currently 1098 houseboats allowed on Shasta Lake, all requiring a Special Use Permit issued annually by the Forest Service. Of the 1098 houseboat permits, 450 are issued to commercial operators for rental use and the remaining 648 are issued to private individuals.

The commercial houseboat permits are allocated to eleven Shasta Lake marinas and the private houseboats are moored at these facilities. Under the terms and conditions in Special Use Permits, private and commercial houseboats are authorized for recreational use only and are not to be used as permanent or seasonal residences.

The type and number of plumbing fixtures on commercial and private houseboats vary. Shasta Lake houseboats may be equipped with one or more toilets, showers, kitchen sinks, bathroom sinks, wet bar sinks, dishwashers, washing machines, and even hot tubs. Since the discharge of toilet wastes to Shasta Lake is prohibited each houseboat is equipped with one or more sewage holding tanks. The Forest Service special use permit presently allows graywater (wastewater) generated from showers, kitchen, and bathroom sinks, wet bars, dishwashers, and washing machines to be directly discharged to Shasta Lake.

CALIFORNIA INLAND LAKES AND RESERVOIRS

In June 2001, Regional Board staff conducted a survey to determine where houseboats are operating on California's inland lakes and if direct graywater discharges to surface water are occurring. Staff discovered that approximately 2381 houseboats are operated on 12 inland lakes. Together, Shasta Lake and Trinity Lake (which is also administered by the Shasta/Trinity National Forest) account for approximately 58 percent of the State's lake and reservoir houseboat fleet, with Shasta Lake representing 46 percent. As shown in the following table, the staff survey revealed that the direct discharge of graywater is allowed only in two inland lakes, Shasta and Trinity. Trinity Lake is in the North Coast Region leaving Shasta Lake as the only lake or reservoir in our Region where graywater discharge from houseboats is permitted.

REGION	LAKE	JURISDICTION	ACRE-FEET	NUMBER of HOUSEBOATS
1	Lake Sonoma	US Army Corps of Engineers	381,000	14
1	Trinity Lake	Shasta-Trinity National Forest	2,447,700	270
5R	Shasta Lake	Shasta-Trinity National Forest	4,552,000	1098
5R	Lake Oroville	CA Dept of Parks & Recreation	3,537,850	400
5S	Lake Berryessa	Bureau of Reclamation	1,600,000	42
5S	Bullards Bar Res.	Yuba County Water Agency	966,103	70
5S	Lake Englebright	Yuba County Water Agency	70,000	97
5S	Lake Don Pedro	Turlock Irrigation District	2,030,000	60
5S	Lake McClure	Merced Irrigation District	1,024,600	239
5S	New Melones	Bureau of Reclamation	2,420,000	108
5F	Pine Flat Lake	US Army Corp of Engineers	1,000,000	82
5F	Lake Success	US Army Corp of Engineers	82,300	79

SEWAGE AND GRAYWATER QUALITY

Staff of the California Department of Health Services, Drinking Water Field Operations Branch, Santa Ana District, (DHS) has prepared a Graywater Technical Paper that compares the quality of residential sewage and graywater. In the technical paper, DHS reports that graywater contains a significant concentration of pathogenic indicator organisms and potential pollutants. The DHS literature search found concentrations of pathogenic bacteria in graywater are similar to concentrations found in typical residential sewage. Due to public

health concerns, DHS adopted regulations (during California's last drought) that prohibit discharge of household graywater unless it is maintained underground at all times.

On 12 June 2001, staff sampled holding tanks from a Lake Oroville commercial houseboat to determine if houseboat sewage and graywater contains the same concentration of pollutants and pathogens reported for residential sewage and graywater. The 16-passenger houseboat was equipped with two toilets that discharge to one-130 gallon holding tank and two bathroom sinks, one wet bar sink, one kitchen sink, one shower, and one dishwasher that discharge to two-130 gallon holding tanks. The houseboat had been rented for 3 days and was sampled upon its return for service. A deodorizing chemical, containing quaternary ammonium chlorides, was used in the houseboat's sewage holding tank. This resulted in elevated ammonia and no fecal coliform bacteria. The analytical results found that toilet waste (sewage), and graywater generated from houseboats, are very similar to wastes generated at typical domestic residences. A tabulation of the findings follows:

CONSTITUENT	UNITS	RESIDENTIAL SEWAGE	RESIDENTIAL GRAYWATER	HOUSEBOAT TOILET WASTE	HOUSEBOAT GRAYWATER
Total Coliform	MPN/100ml	1-10 million	10^2-1billion	240 million	>24 million
Fecal Coliform	MPN/100ml	10-100 thousand	10^1-1 million	<20,000	2.2 million
BOD	mg/L	220	40-620	1920	394
COD	mg/L	500	60-1610	8110	1130
Ammonia	mg/L	25	0.15-12	493	28
Nitrate as (N)	mg/L	0	0-4.9	0.13	0.13
Total Kjeldhal N	mg/L	40	0.6-50	62	62
Turbidity	NTU	20-140	20-140	200	1400

COLIFORM BACTERIA AND SHASTA LAKE

The Basin Plan designates numeric and narrative water quality objectives for inland surface waters, such as Shasta Lake. For contact recreation, the numeric objective for fecal coliform bacteria based on a minimum of five samples for any 30-day period is 200/100 ml (the geometric mean) and 400/100 ml, the maximum for no more than ten percent of the samples. Since Shasta Lake is designated for use as a municipal and domestic supply, the Basin Plan specifies that the concentration of chemical constituents shall not exceed maximum contaminant levels (MCL). The MCL for coliform organisms in drinking water is <2.2 MPN/100 ml.

Samples collected from the lake's surface, at various Shasta Lake marinas, show somewhat elevated total and fecal coliform bacteria. The marina samples have average total coliform concentrations of 53 to 393 MPN/100 ml and fecal coliform concentrations of 21 to 220 MPN/100 ml fecal coliform. Surface samples collected in Shasta Lake, away from concentrated houseboat use, generally found average total and fecal coliform concentrations of 9 and <2.2 MPN/100ml, respectively. One sample, collected at a marina where houseboats were occupied and discharging graywater while still moored, contained total and fecal coliform concentrations of $\geq$ 1600 MPN/100ml. The continued discharge of graywater from houseboats to Shasta Lake causes and threatens to cause pollution, nuisance, and the impairment of beneficial uses as defined in the California Water Code. Staff, to prevent degradation in the

marina areas, has revised waste discharge requirements for five marinas on Shasta Lake that prohibit the discharge of graywater from houseboats while moored at the marina. These requirements are included in this agenda as uncontested items. Staff intends to revise the waste discharge requirements for the remaining six marinas and present them to the Board at a future meeting.

FEASIBILITY ANALYSIS

A few of the newer replacement commercial and private houseboats placed on Shasta Lake have one or more graywater holding tanks installed. Although the graywater holding tanks on these houseboats are not being used, it demonstrates the feasibility of installing holding tanks on houseboats. Shasta Lake marinas currently have facilities to store or dispose of houseboat toilet wastes and could possibly accommodate additional wastewater from graywater holding tanks. However, it is the consensus of the marina owners, the Forest Service and staff that new or expanded sewage storage and/or disposal facilities are required to handle the additional wastewater flows generated when all houseboats utilize holding tanks to contain graywater. An appropriate time schedule, not expected to exceed 5 years, will need to be developed and included in a formal agreement, or enforcement order, to assure that houseboats are retrofitted to include holding tanks and onshore disposal facilities are constructed.

REGULATORY OPTIONS

Staff considered the following options to control graywater pollution from Shasta Lake houseboats:

1. Waste Discharge Requirements and National Pollutant Discharge Elimination System (NPDES) permits for each houseboat owner, a total of 1098 permits,

2. Enforcement action against the Forest Service, the permitting and control agency regulating houseboat discharges and usage, or

3. Development of an acceptable Memorandum of Understanding (MOU) with the Forest Service to require holding of all graywater generated on houseboats, including a time schedule for developing appropriate onshore handling and disposal facilities.

Staff met with the Shasta –Trinity Forest Supervisor to discuss these options. The Forest Supervisor agreed to work cooperatively with staff and agreed to the concept of an MOU with the Board to eliminate graywater discharges to Shasta Lake.

RECOMMENDATION

Staff recommends entering into a Memorandum of Understanding with the Forest Service in lieu of issuing individual permits or initiating enforcement action.